HOW TO SELECT A POWER METER

By Burt Mooney
Ophir-Spiricon

How to select a power meter

- The first thing one generally has to do is look in depth at what type of laser has, and its parameters that one needs to measure.
- From that information you can determine what type of sensor (detector) one needs and then look at the instrument one will need to display the results.

Determining Sensor Type

- Is laser Continuous Wave (CW)?
- Is laser Pulsed?
- Wavelength?
- Min and Max Energy or Power?
- Beam size

Determining Sensor Type

- If the laser is continuous you will either need a thermopile or photodiode sensor.
- Knowing the min and max power and wavelength range will determine which of these to choose.

Determining Sensor Type

- Thermopiles
  - Spectrally broadband from UV to FAR IR
  - 50 microW to 10 kiloW
- Photodiodes
  - Not spectrally flat, limited spectral range
  - Silicon 190 -1100 nm
  - Germanium 700 – 1800 nm
  - InGaAs 800 – 1700
  - picoW – 1 W

Determining Sensor Type if Thermopile

- **Two Types of Absorbers**
  - **Surface Absorbers**
    - The laser light is absorbed in the front surface of the sensor.
    - Optical black paint: 500 W/cm2, 50 mJ/cm2 @ 10 nsec
    - High Temp Ceramic: 26 kW/cm2, 300 mJ/cm2 @ 10 nsec
  - **Volume Absorbers**
    - The laser light is absorbed in a bulk material and then conducted to the metal disc.
    - Typical lasers include Q-switched relative high energy Nd:YAG, Ruby, Alexandrite, and

If Your Laser is Pulsed

- You may need a pyroelectric sensor if:
  - Rep rate is single shot to 25 kHz
  - Spectrally broadband from UV to FAR IR

Watt's a Joule?

- Conversely, if one knows the Average Power and repetition frequency, one can get the Average Energy per pulse.
- Energy = Average Power divided by pulse repetition frequency, i.e. 1 mJ = 1 W/1 kHz.

Watt's a Joule?

- **Peak Power**
- Watts of Peak Power = Energy in Joules divided by pulsewidth (FWHM), For example:
- 1 Joule @ 10 nsec = 100 MegaWatts
- **Fluence** , or energy density per unit area, is just Energy divided by area being irradiated.
  If energy is known just divide by area.
  For example: 1 mJ pulse in a 1 cm2 area = 1 mJ/ cm2
- **Irradiance,** or power density per unit area, is just Power divided by area

Selecting an Instrument Readout

- What features do you need?
  - Statistics on board?
  - Portability?
  - Battery Operation?
  - Computer interface?
  - User interface?
  - Multi-channel?
  - Wireless?

That's It